L-3/T-1/ARCH **Date : 09/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Arch. Examinations 2010-2011

Sub : **CE 321** (Structure III : Mechanics of Solids)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **SEVEN** questions in this section. Answer any **FIVE**.

1. Draw bending stress distribution diagram of the beam of Fig. 1 at support. **(14)**

2. Calculate the elastic moment capacity and plastic moment capacity of the T-section of Fig. 2. Also calculate shape factor. $F_y = 36$ ksi. **(14)**

3. Draw the shear stress distribution diagram of the T-section of Fig. 2 which is subjected to a vertical shear of 25 kip. **(14)**

4. A I-section of a beam is made of three wooden planks which are nailed to each other as shown in Fig. 3. This beam has to carry maximum vertical shear of 700 lb and nail spacing is 1.5 inch, calculate the factor of safety of the nail joint, if capacity of a nail is 150 lb. **(14)**

5. A composite beam of wood and steel, as shown in Fig. 4, is subjected to a bending moment of 100 kip-ft around its horizontal axis. Calculate the maximum stresses in steel and wood. $E_w = 1.5 \times 10^6$ psi, $E_s = 30 \times 10^6$ psi. **(14)**

6. Calculate maximum deflection and maximum rotation of the beam of Fig. 5. Consider EI constant. **(14)**

7. Calculate the deflection and rotation at midspan of the beam of Fig. 6. $E = 5 \times 10^6$ psi, $I = 1440$ in^4. **(14)**

SECTION – B

There are **SEVEN** questions in this section. Answer any **FIVE**.

8. Determine the equivalent state of stress on an element if the element is oriented 60° clockwise from the element shown in Fig. 7. **(14)**

Contd P/2

CE 321

9. Using Mohr's circle of stresses, for the element shown in Fig. 7. **(14)**

   (a) Find the principal stresses and show their directions on properly oriented element.

   (b) Find the maximum shear stresses and associated normal stresses, if any. Show their proper orientation.

10. Determine the reactions at the supports A and B. Then draw moment diagram. EI is constant. (Fig. 8) **(14)**

11. Determine the displacement at point C for the steel overhanging beam shown in Fig. 9. Use $E_s = 29000$ ksi, $I = 125$ in^4. **(14)**

12. The beam is subjected to the loading shown in Fig. 10. Determine the equation of the elastic curve and deflection at point D. EI is constant. **(14)**

13. The A-36 steel W8 × 31 member shown in Fig. 11 is to be used as a pin-connected column. Determine the largest axial load it can support before it either begins to buckle or the steel yields. (Given, $A = 9.13$ in^2, $I_x = 110$ in^4, $I_y = 37.1$ in^4) **(14)**

14. Determine the capacity of a 15′ long steel column of W8 × 67 section ($A = 19.7$ in^2, $r_{xx} = 3.71''$ and $r_{yy} = 2.12''$The column is fixed at one end and pin-connected at other end. Use A-36 steel. Use AISC/ASD method. **(14)**

CE 321

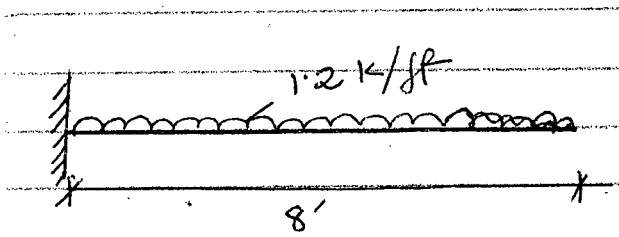
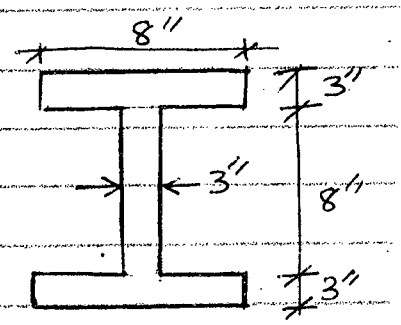


Fig-1



Beam Section

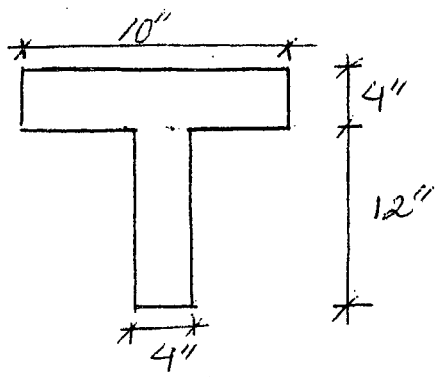


Fig-2

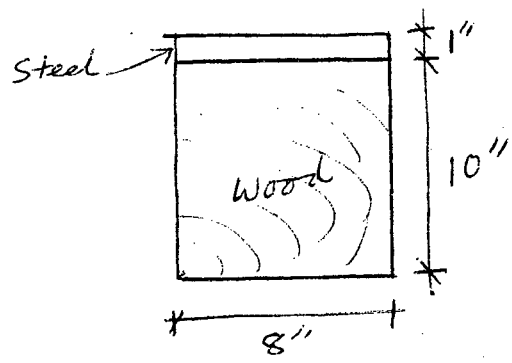
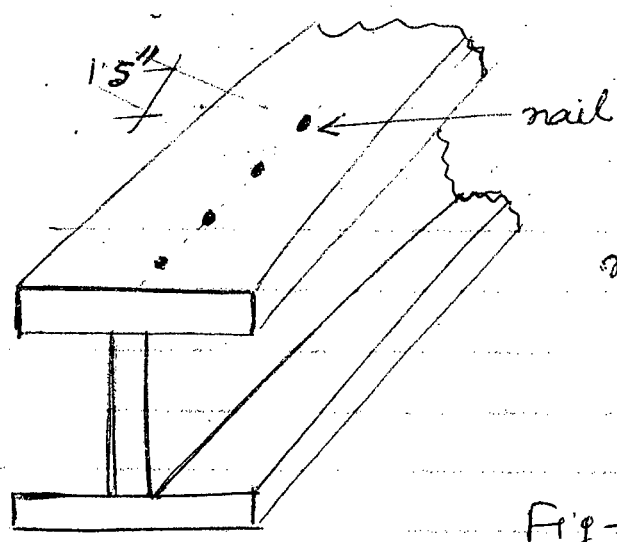


Fig-4



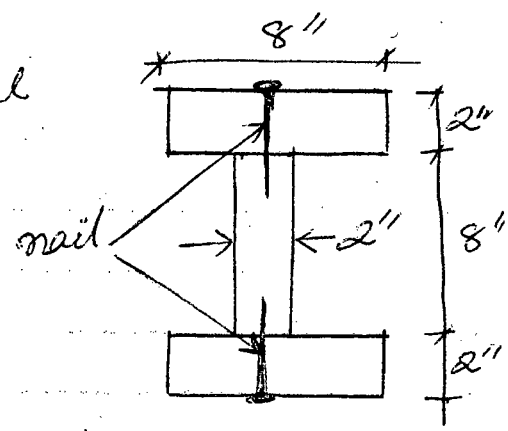


Fig-3

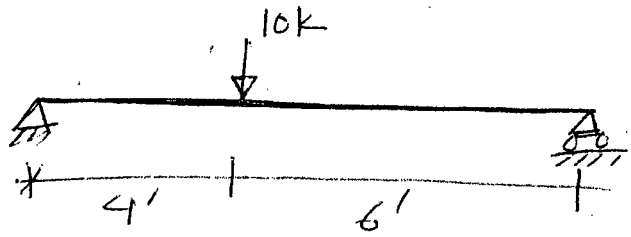


Fig-5

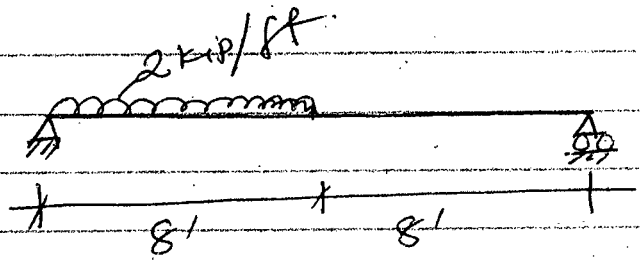


Fig-6

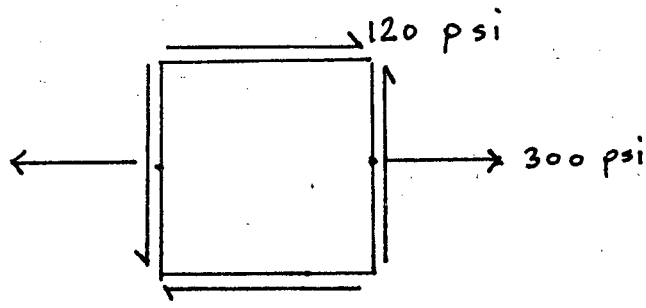


Fig. 7

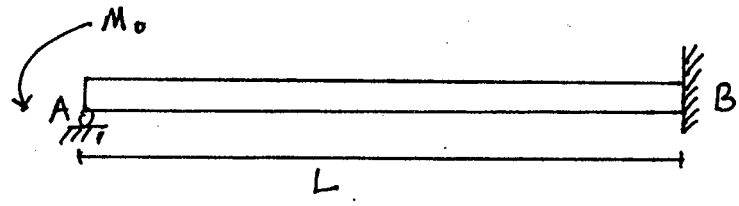


Fig. 8

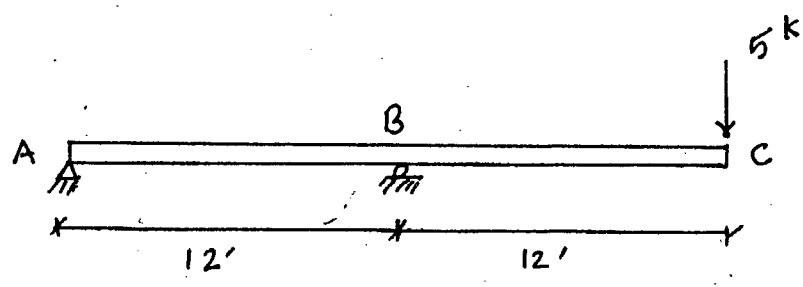


Fig. 9

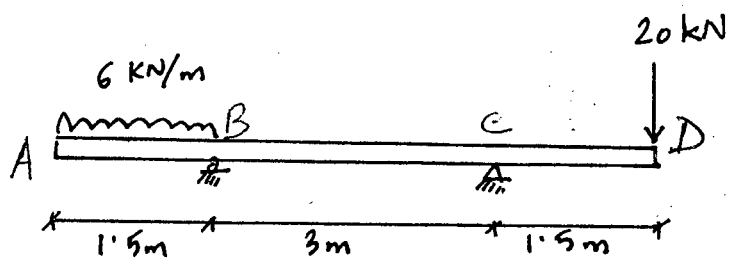


Fig. 10

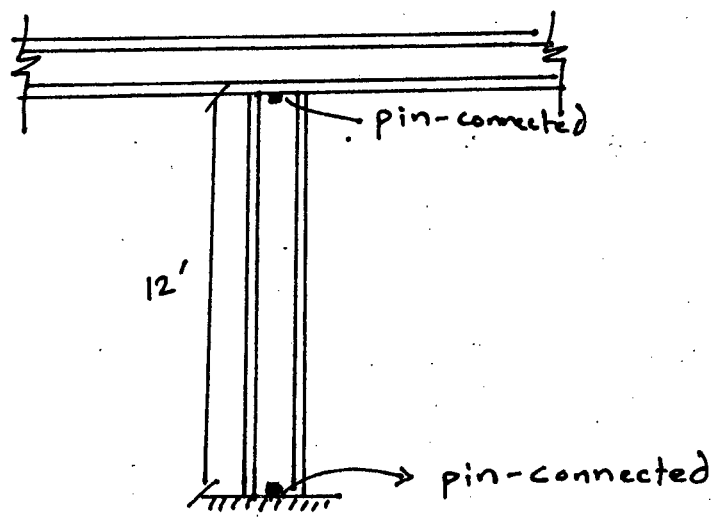


Fig. 11

Shareen 16/01/12

L-3/T-1/ARCH **Date : 16/01/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Arch. Examinations 2011-2012

Sub : **ARCH 341** (Art and Architecture IV)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer Q. No. **1** and any **TWO** from the rest.

1. (a) Describe and Illustrate the major differences between Mosque and Temple. **(10)**

   (b) Illustrate the chronological development of Qutb Mosque through different dynasties. **(14)**

2. (a) Draw sketches to show that evolution of arches including those in 'Quwat-ul-Islam Mosque'; 'Alai Darwaza' and Tomb of Ghiyas-ud-din-Tughlaq'. **(17)**

   (b) Briefly describe 'Tomb of Iltutmish'. **(06)**

3. (a) Describe 'Alai Darwza' as a unique architectural piece. **(10)**

   (b) Explain the uniqueness of 'Khirki Masjid'. **(13)**

4. (a) Describe architectural characteristics of Sayyid and Lodi dynasties. **(06)**

   (b) Describe Firoz Shah Kotla as the pioneer of Islamic cities on Indian soil. **(10)**

   (c) Octagonal tomb of Khan-e-Jahan Telengani-Describe and Illustrate. **(07)**

SECTION – B

There are **FOUR** questions in this Section. Answer Q. No. **5** and any **two** from the rest.

5. Write short notes on (any three): **(24)**

   (a) Char Bagh.

   (b) Akbar's all India Architecture.

   (c) Dewan-i-Khas at Fatehpur Sikri.

   (d) Birbal's Palace at Fatehpur Sikri.

6. (a) Critically describe Fatehpur Sikri city in connection with the following aspects. **(13)**

   (i) Concepts of planning

   (ii) Visual unity and diversity

   (iii) Material and landscape.

   (b) Discuss the specific features of Buland Darwaza. **(10)**

Contd P/2

ARCH 341

7. (a) "Tajmahal is a complete architectural experience" explain with reference to. **(13)**

   (i) Concept, zoning and balance

   (ii) Space sequence. Use sketches.

   (b) Explain with sketches that Jami Mosque of Delhi stands as ideal form of mosque of the Mughal period. **(10)**

8. (a) Describe the tomb of Humayun as a fusion and logical synthesis of two great architectural traditions 'Persian' and 'Indian'. **(12)**

   (b) Critically evaluate the space articulation, architectural character and features applied in its plans and elevations identifying their origin and local modifications of 'the Jahangiri Mahal' **(11)**

L-3/T-1/ARCH **Date : 22/01/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Arch. Examinations 2010-2011

Sub : **ME 363** (Mechanical Equipment)

Full Marks: 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Define: Wet bulb temperature, Relative humidity, Specific humidity. **(6)**

   (b) Label the moist-air properties plotted on the standard psychrometric chart. What is the significance of 100% humidity line? **(5⅓)**

   (c) 1 lb of air at 78°F and 0.012 lb/(lb dry air) is mixed with 3 lb of air at 105°F and 0.02 lb/(lb dry air) to form a mixture. What will be the overall condition of the mixture? **(12)**

2. (a) Describe the process involved during Sensible heating with the use of a psychrometric chart. Air at 45°F dry bulb temperature and 60% RH is heated to 60°F dry bulb temperature by passing it over an electrical heating element. Determine the corresponding wet bulb temperature, dew point temperature and moisture content. **(11⅓)**

   (b) Estimate cooling load using CLTD method at 15:00/16th May in Bangladesh. A (10×10 m) Roof with type 4, 50 mm insulation without suspended ceiling is obtained here. **(12)**

   Given, $T_i = 25.5\ ^{o}C$

   $T_{0,\,av} = 27.5\ ^{o}C$.

3. (a) At 24°N latitude during 17:00/12th April, determine the total heat gain through a window on the west side of a room. **(13)**

   Given, 6 m^2 unshades window

   13 mm thickness light concentration

   Single glass ($h_o = 7$)

   Overall heat conductance 2.86 W/m^2k.

   (b) What is ton of refrigeration? Describe on of refrigeration in Btu/hr. **(5)**

   (c) What are the desirable properties of a refrigerant. **(5⅓)**

4. (a) Draw a block diagram of a vapor compression refrigeration system showing the major components. **(8)**

   (b) Describe the processes which constitute the vapor compression refrigeration cycle with P-h and T-s diagrams. **(7⅓)**

Contd P/2

ME 363

(c) What is meant by COP? A refrigerator using refrigerant R-134a as a working fluid operates on an ideal vapor compression cycle between 0.12 and 0.7 MPa. The mass flow rate is 0.06 kg/s. Enthalpy of refrigerant before and after compression are 385.45 kJ/kg and 428 kJ/kg respectively. Enthalpy after condensation is 236 kJ/kg. Determine the COP. **(8)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

Necessary tables and charts are supplied.

5. (a) Explain how an automatic sprinkler works. Draw the exploded views of a solder type of automatic sprinkler. **(15)**

   (b) Write a short paragraph on the piping arrangement for automatic sprinkler system. **(8⅓)**

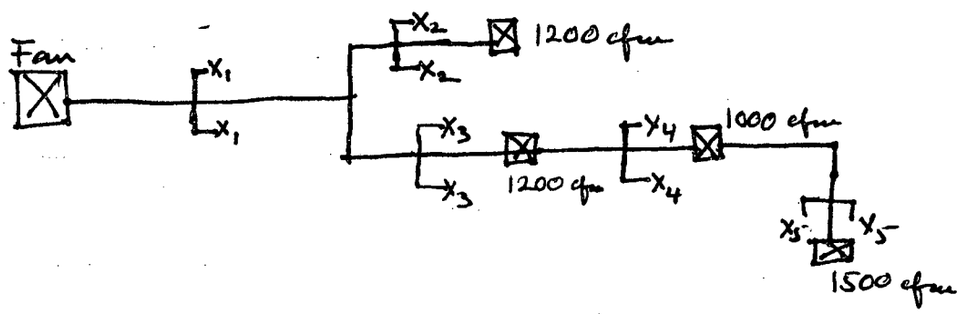
6. (a) Show the car-groupings for multiple elevators in a building complex. **(8)**

   (b) What are 1:1 and 2:1 roping system? **(7⅓)**

   (c) What is meant by 'five-minutes peak' passenger handling in elevatoring. **(8)**

7. (a) In air-conditioning ducting system why the ducts are normally square or rectangular in section rather than circular? What are different methods of duct-design? **(5⅓)**

   (b) Calculate the duct size at sections shown. The structural design limits the depth of the duct not to exceed 15″. The building is commercial one **(18)**



8. Write notes on **(23⅓)**

   (a) Escalators

   (b) Door arrangement of lifts

   (c) Incoming and outgoing traffics

   (d) Fire hazards.

TABLE 11 Recommended indoor temperature and relative humidity for summer cooling

Type of premise	Dry bulb temperature (°C)	Minimum relative humidity
Offices	25.5	55%
Cafetarias	24.0	55%
Auditoriums	25.5	50%
Computer rooms	24.0	As needed
Department stores	26.5	55%
Supermarkets	25.5	55%
Factory	22	50%
Residence	25.5	55%

12 Roof Construction Code

Roof No.	Description	Code Numbers of Layers (see Table 8)
1	Steel Sheet with 25-mm insulation	A0, E2, E3, B5, A3, E0
2	25-mm wood with 25-mm insulation	A0, E2, E3, B5, B7, E0
3	100-mm l. w. concrete	A0, E2, E3, C14, E0
4	50-mm h.w. concrete with 25-mm insulation	A0, E2, E3, B5, C12, E0
5	25-mm wood with 50-mm insulation	A0, E2, E3, B6, B7, E0 -A0, E2, E3, B5, C12, E0
5	25-mm wood with 50-mm insulation	A0, E2, E3, B6, B7, E0
6	150-mm l. w. concrete	A0, E2, E3, C15, E0
7	63-mm wood with 25-mm insulation	A0, E2, E3, B5, B8, E0
8	200-mm l. w. concrete	A0, E2, E3, C16, E0
9	100-mm h. w. concrete with 25-mm insulation	A0, E2, E3, B5, C5, E0
10	63-mm wood with 50-mm insulation	A0, E2, E3, B6, B8, E0
11	Roof terrace system	A0, C12, B1, B6, E2, E3, C5, E0
12	150-mm h. w. concrete with 25-mm insulation	A0, E2, E3, B5, C13, E0
13	100-mm wood with 25-mm insulation	A0, E2, E3, B5, B9, E0

TABLE 12 Cooling load temperature differences (CLTD) for calculating cooling load from flat roofs

Roof no.	Description of construction	Mass, kg/m²	U-value W/m²·°C	Solar time 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Maximum CLTD	Hours of Minimum CLTD	Hours of Maximum CLTD	Difference CLTD
Without Suspended Ceiling																															
1	Steel sheet with 25 mm (or 50 mm) insulation	34 (39)	1.209 (0.704)	0	−1	−2	−2	−3	−2	3	11	19	27	34	40	43	44	43	39	33	25	17	10	7	5	3	1	14	−3	44	47
2	25 mm wood with 25 mm insulation	39	0.965	3	2	0	−1	−2	−2	−1	2	8	15	22	29	35	39	41	41	39	35	29	21	15	11	8	5	16	−2	41	43
3	100 mm l.w. concrete	88	1.209	5	3	1	0	−1	−2	−2	1	5	11	18	25	31	36	39	40	40	37	32	25	19	14	10	7	16	−2	40	42
4	50 mm h.w. concrete with 25 mm (or 50 mm) ins.	142	1.170 (0.693)	7	5	3	2	0	−1	0	2	6	11	17	23	28	33	36	37	37	34	30	25	20	16	12	10	16	−1	37	38
5	25 mm wood with 50 mm insulation	44	0.619	2	0	−2	−3	−4	−4	−4	−2	3	9	15	22	27	32	35	36	35	32	27	20	14	10	6	3	16	−4	36	40
6	150 mm l.w. concrete	117	0.897	12	10	7	5	3	2	1	0	2	4	8	13	18	24	29	33	35	36	35	32	28	24	19	16	18	0	36	36
7	60 mm wood with 25 mm insulation	63	0.738	16	13	11	9	7	6	4	3	4	5	8	11	15	19	23	27	29	31	31	30	27	25	22	19	19	3	31	28
8	200 mm l.w. concrete	151	0.715	20	17	14	12	10	8	6	5	4	4	5	7	11	14	18	22	25	28	30	30	29	27	25	22	20	4	30	26
9	100 mm h.w. concrete with 25 mm (or 50 mm) ins.	254 (254)	1.136 (0.681)	14	12	10	8	7	5	4	4	6	8	11	15	18	22	25	28	29	30	29	27	24	21	19	16	18	4	30	26
10	60 mm wood will 50 mm insulation	63	0.528	18	15	13	11	9	8	6	5	5	5	7	10	13	17	21	24	27	28	29	29	27	25	23	20	19	5	29	24
11	Roof terrace system	366	0.602	19	17	15	14	12	11	9	8	7	8	8	10	12	15	18	20	22	24	25	26	25	24	22	21	20	7	26	19
12	150 mm h.w. concrete with 25 mm (or 50 mm) ins.	366 (366)	(1.090) (0.664)	18	16	14	12	11	10	9	8	8	9	10	12	15	17	20	22	24	25	25	25	24	22	20	19	19	8	25	17
13	100 mm wood with 25 mm (or 50 mm) insulation	83 (88)	0.602 (0.443)	21	20	18	17	15	14	13	11	10	9	9	9	10	12	14	16	18	20	22	23	24	24	23	22	22	9	24	15
With Suspended Ceiling																															
1	Steel Sheet with 25 mm (or 50 mm) insulation	44 (49)	0.761 (0.522)	1	0	−1	−2	−3	−3	0	5	13	20	28	35	40	43	43	41	37	31	23	15	10	7	5	3	15	−3	43	46
2	25 mm wood with 25 mm insulation	49	0.653	11	8	6	5	3	2	1	2	4	7	12	17	22	27	31	33	35	34	32	28	24	20	17	14	17	1	35	34
3	100 mm l.w. concrete	97	0.761	10	8	6	4	2	1	0	0	2	6	10	16	21	27	31	34	36	36	34	30	26	21	17	13	17	0	36	36
4	50 mm h.w. concrete with 25 mm insulation	146	0.744	16	14	13	11	10	8	7	7	8	9	11	14	17	19	22	24	25	26	26	25	23	21	20	18	18	7	26	19
5	25 mm wood with 50 mm insulation	49	0.471	14	11	9	7	5	4	3	3	4	6	10	14	18	23	27	30	31	32	31	29	26	22	19	16	18	3	32	30
6	150 mm l.w. concrete	127	0.619	18	15	13	11	9	7	6	4	4	4	6	9	12	16	20	24	27	29	30	30	28	26	23	20	20	4	30	26
7	60 mm wood with 25 mm insulation	73	0.545	19	18	16	14	13	12	10	9	8	8	9	10	12	14	17	19	21	23	24	25	24	23	22	21	20	8	25	17
8	200 mm l.w. concrete	161	0.528	22	20	18	16	15	13	11	10	9	8	8	8	9	11	14	16	19	21	23	25	25	25	24	23	20	8	25	17
9	100 mm h.w. concrete with 25 mm (or 50 mm) ins.	259 (264)	0.727 (0.511)	17	16	15	14	13	13	12	11	11	11	12	13	15	16	18	19	20	21	21	21	21	20	19	18	19	11	21	10
10	60 mm wood with 50 mm insulation	73	0.409	19	18	17	16	14	13	12	11	10	10	10	11	12	14	16	18	19	21	22	23	23	22	22	21	21	10	23	13
11	Roof terrace system	376	0.466	17	16	16	15	15	14	13	13	13	12	12	13	13	14	15	16	16	17	18	18	19	18	18	18	21	12	19	7
12	150 mm h.w. concrete with 25 mm (or 50 mm) ins.	376	0.710	16	16	15	15	14	13	13	12	12	12	12	13	14	15	16	17	18	18	19	19	19	18	18	18	20	12	19	7
13	100 mm wood with 25 mm (or 50 mm) insulation	93 (97)	0.465 (0.363)	20	19	19	18	17	16	15	14	14	13	12	12	12	12	13	14	15	16	18	19	20	20	20	20	23	12	20	8

Adapted by permission from *ASHRAE Fundamentals*, 1989, Table 29.

TABLE 15 CLTD correction for latitude and month applied to walls and roofs, north latitudes

Lat.	Month	N	NNE NNW	NE NW	ENE WNW	E W	ESE WSW	SE SW	SSE SSW	S	HOR
0	Dec	−1.6	−2.7	−2.7	−2.7	−1.1	0.0	1.6	3.3	5.0	−0.5
	Jan/Nov	−1.6	−2.7	−2.2	−2.2	−0.5	0.0	1.1	2.2	3.8	−0.5
	Feb/Oct	−1.6	−1.1	−1.1	−1.1	−0.5	−0.5	0.0	−0.5	−3.8	0.0
	Mar/Sept	−1.6	0.0	0.5	−0.5	−0.5	−1.6	−1.6	−2.7	−4.4	0.0
	Apr/Aug	2.7	2.2	1.6	0.0	−1.1	−2.7	−3.3	−4.4	−4.4	−1.1
	May/Jul	5.5	3.8	2.7	0.0	−1.6	−3.8	−4.4	−5.0	−4.4	−2.2
	Jun	6.6	5.0	2.7	0.0	−1.6	−3.8	−5.0	−5.5	−4.4	−2.7
8	Dec	−2.2	−3.3	−3.3	−3.3	−1.6	0.0	2.2	4.4	6.6	−2.7
	Jan/Nov	−1.6	−2.7	−3.3	−2.7	−1.1	0.0	1.6	3.3	5.5	−2.2
	Feb/Oct	−1.6	−2.2	−1.6	−1.6	−0.5	−0.5	0.5	1.1	2.2	−0.5
	Mar/Sept	−1.6	−1.1	−0.5	−0.5	−0.5	−1.1	−1.1	−1.6	−2.2	0.0
	Apr/Aug	1.1	1.1	1.1	0.0	−0.5	−2.2	−2.7	−3.8	−3.8	−0.5
	May/Jul	3.8	2.7	2.2	0.0	−1.1	−2.7	−3.8	−5.0	−3.8	−1.1
	Jun	5.0	3.3	2.2	0.0	−1.1	−3.3	−4.4	−5.0	−3.8	−1.1
16	Dec	−2.2	−3.3	−4.4	−4.4	−2.2	−0.5	2.2	5.0	7.2	−5.0
	Jan/Nov	−2.2	−3.3	−3.8	−3.8	−2.2	−0.5	2.2	4.4	6.6	−3.8
	Feb/Oct	−1.6	−2.7	−2.7	−2.2	−1.1	0.0	1.1	2.7	3.8	−2.2
	Mar/Sept	−1.6	−1.6	−1.1	−1.1	−0.5	−0.5	0.0	0.0	0.0	−0.5
	Apr/Aug	−0.5	0.0	−0.5	−0.5	−0.5	−1.6	−1.6	−2.7	−3.3	0.0
	May/Jul	2.2	1.6	1.6	0.0	−0.5	−2.2	−2.7	−3.8	−3.8	0.0
	Jun	3.3	2.2	2.2	0.5	−0.5	−2.2	−3.3	−4.4	−3.8	0.0
24	Dec	−2.7	−3.8	−5.0	−5.5	−3.8	−1.6	1.6	5.0	7.2	−7.2
	Jan/Nov	−2.2	−3.3	−4.4	−5.0	−3.3	−1.6	1.6	5.0	7.2	−6.1
	Feb/Oct	−2.2	−2.7	−3.3	−3.3	−1.6	−0.5	1.6	3.8	5.5	−3.8
	Mar/Sept	−1.6	−2.2	−1.6	−1.6	−0.5	−0.5	0.5	1.1	2.2	−1.6
	Apr/Aug	−1.1	−0.5	0.0	−0.5	−0.5	−1.1	−0.5	−1.1	−1.6	0.0
	May/Jul	0.5	1.1	1.1	0.0	0.0	−1.6	−1.6	−2.7	−3.3	0.5
	Jun	1.6	1.6	1.6	0.5	0.0	−1.6	−2.2	−3.3	−3.3	0.5
32	Dec	−2.7	−3.8	−5.5	−6.1	−4.4	−2.7	1.1	5.0	6.6	−9.4
	Jan/Nov	−2.7	−3.8	−5.0	−6.1	−4.4	−2.2	1.1	5.0	6.6	−8.3
	Feb/Oct	−2.2	−3.3	−3.8	−4.4	−2.2	−1.1	2.2	4.4	6.1	−5.5
	Mar/Sept	−1.6	−2.2	−2.2	−2.2	1.1	−0.5	1.6	2.7	3.8	−2.7
	Apr/Aug	−1.1	−1.1	−0.5	−1.1	0.0	−0.5	0.0	0.5	0.5	−0.5
	May/Jul	0.5	0.5	0.5	0.0	0.0	−0.5	−0.5	−1.6	−1.6	0.5
	Jun	0.5	1.1	1.1	0.5	0.0	−1.1	−1.1	−2.2	−2.2	1.1

(Contd.)

Adapted by permission from *ASHRAE Fundamentals*, 1989, Table 32.

TABLE . Thermal properties and code numbers of layers used in wall and roof descriptions

Code number	Description	Thickness and thermal properties					
		L	k	p	c_p	R	Mass
A0	Outside surface resistance	0	0.000	0	0.00	0.059	0.00
A1	25 mm stucco	25	0.692	1858	0.84	0.037	47.34
A2	100 mm facebrick	100	1.333	2002	0.92	0.076	203.50
A3	Steel siding	2	44.998	7689	0.42	0.000	11.71
A4	12 mm slag	13	0.190	1121	1.67	0.067	10.74
A5	Outside surface resistance	0	0.000	0	0.00	0.059	0.00
A6	Finish	13	0.415	1249	1.09	0.031	16.10
A7	100 mm facebrick	100	1.333	2002	0.92	0.076	203.50
B1	Air space resistance	0	0.000	0	0.00	0.160	0.00
B2	25 mm insulation	25	0.043	32	0.84	0.587	0.98
B3	50 mm insulation	51	0.043	32	0.84	1.173	1.46
B4	75 mm insulation	76	0.043	32	0.84	1.760	2.44
B5	25 mm insulation	25	0.043	91	0.84	0.587	2.44
B6	50 mm insulation	51	0.043	91	0.84	1.173	4.88
B7	25 mm wood	25	0.121	593	2.51	1.760	15.13
B8	62 mm wood	63	0.121	593	2.51	0.524	37.55
B9	100 mm wood	101	0.121	593	2.51	0.837	60.02
B10	50 mm wood	51	0.121	593	2.51	0.420	30.26
B11	75 mm wood	76	0.121	593	2.51	0.628	45.38
B12	75 mm insulation	76	0.043	91	0.84	1.760	6.83
B13	100 mm insulation	100	0.043	91	0.84	2.347	9.27
B14	125 mm insulation	125	0.043	91	0.84	2.933	11.71
B15	150 mm insulation	150	0.043	91	0.84	3.520	14.15
B16	4 mm insulation	4	0.043	91	0.84	0.088	0.49
B17	8 mm insulation	8	0.043	91	0.84	0.176	0.49
B18	12 mm insulation	12	0.043	91	0.84	0.264	0.98
B19	15 mm insulation	15	0.043	91	0.84	0.352	1.46
B20	20 mm insulation	20	0.043	91	0.84	0.440	1.95
B21	35 mm insulation	35	0.043	91	0.84	0.792	2.93
B22	42 mm insulation	42	0.043	91	0.84	0.968	3.90
B23	60 mm insulation	62	0.043	91	0.84	1.408	5.86
B24	70 mm insulation	70	0.043	91	0.84	1.584	6.34

(Contd.)

TABLE Thermal properties and code numbers of layers used in wall and roof descriptions (Contd.)

Code number	Description	Thickness and thermal properties					
		L	k	p	c_p	R	Mass
B25	85 mm insulation	85	0.043	91	0.84	1.936	7.81
B26	92 mm insulation	92	0.043	91	0.84	2.112	8.30
B27	115 mm insulation	115	0.043	91	0.84	2.640	10.74
C1	100 mm clay tile	100	0.571	1121	0.84	0.178	113.70
C2	100 mm lightweight concrete block	100	0.381	609	0.84	0.266	61.98
C3	100 mm heavy weight concrete block	100	0.813	977	0.84	0.125	99.06
C4	100 mm common brick	100	0.727	1922	0.84	0.140	195.20
C5	100 mm heavy weight concrete	100	1.731	2243	0.84	0.059	227.90
C6	200 mm clay tile	200	0.571	1121	0.84	0.352	227.90
C7	200 mm lightweight concrete block	200	0.571	609	0.84	0.352	123.46
C8	200 mm heavy weight concrete block	200	1.038	977	0.84	0.196	198.62
C9	200 mm common brick	200	0.727	1922	0.84	0.279	390.40
C10	200 mm heavy weight concrete	200	1.731	2243	0.84	0.117	455.79
C11	300 mm heavy weight concrete	300	1.731	2243	0.84	0.176	683.20
C12	50 mm heavy weight concrete	50	1.731	2243	0.84	0.029	113.70
C13	150 mm heavy weight concrete	150	1.731	2243	0.84	0.088	341.60
C14	100 mm lightweight concrete	100	0.173	641	0.84	0.587	64.90
C15	150 mm lightweight concrete	150	0.173	641	0.84	0.880	97.60
C16	200 mm lightweight concrete	200	0.173	641	0.84	1.173	130.30
C17	200 mm lightweight conc blk. (filled)	200	0.138	288	0.84	1.467	58.56
C18	200 mm heavy weight conc. blk. (filled)	200	0.588	849	0.84	0.345	172.75
C19	300 mm lightweight conc. blk. (filled)	300	0.138	304	0.84	2.200	92.72
C20	300 mm heavy weight conc. blk. (filled)	300	0.675	897	0.84	0.451	273.28
E0	Inside surface resistance	0	0.000	0	0.00	0.121	0.00
E1	20 mm plaster or gypsum	20	0.7277	1602	0.84	0.026	30.74
E2	12 mm slag or stone	12	1.436	881	1.67	0.099	11.22
E3	10 mm felt and membrane	10	0.190	1121	1.67	0.050	10.74
E4	Ceiling air space	0	0.000	0	0.00	0.176	0.00
E5	Acoustic tile	19	0.061	481	0.84	0.314	9.27

L = thickness mm, K = thermal conductivity, W/(m·°C), p = density, kg/m^3, c_p = specific heat. kJ/(kg·°C), R = thermal resistance. (m^2·°C)/W. Mass = kg/m^2

Adapted by permission from *ASHRAE Fundamentals*, 1989, Table 11.

TABLE 13 a) Maximum solar heat gain factor (W/m^2) for sunlit glass, north latitudes (Contd.)

	24°N Lat								
	N	NNE/ NNW	NE/ NW	ENE/ WNW	E/ W	ESE/ WSW	SE/ SW	SSE/ SWW	S	HOR
Jan.	85	85	129	404	599	757	798	760	716	675
Feb.	95	95	252	521	694	770	767	672	606	786
Mar.	107	142	391	615	738	748	675	530	432	868
Apr.	117	278	502	659	719	669	533	338	237	893
May	136	369	562	675	688	599	416	211	145	890
June	174	401	581	675	669	565	369	174	136	880
July	142	366	555	663	672	584	407	205	145	877
Aug.	120	274	492	640	694	644	511	325	227	874
Sep.	110	133	375	584	700	710	650	514	423	839
Oct.	98	98	249	502	666	748	741	653	590	770
Nov.	85	85	133	398	590	745	786	748	707	672
Dec.	82	82	91	353	568	738	779	779	748	628

TABLE 13 b) Maximum solar heat gain factor (SHGF) for externally shaded glass (W/m^2) (Based on ground reflectance of 0.2)

Use for latitudes 0 to 24 deg.
For latitudes greater than 24, use north orientation, Table A4(a).
For horizontal glass in shade, use the tabulated values for all latitudes.

	N	NNE/ NNW	NE/ NW	ENE/ WNW	E/ W	ESE/ WSW	SE/ SW	SSE/ SWW	S	(All Lat.) HOR
Jan.	98	98	98	101	107	114	117	117	120	50
Feb.	107	107	107	110	114	117	120	120	123	50
Mar.	114	114	117	120	123	126	126	123	123	60
Apr.	126	126	130	133	133	133	129	126	126	76
May	137	139	142	145	142	136	129	126	126	88
June	142	145	148	148	145	139	129	126	126	98
July	142	142	145	148	148	142	133	129	129	98
Aug.	133	133	136	142	145	142	136	133	133	88
Sept.	117	117	120	126	129	133	133	129	129	73
Oct.	107	107	107	114	120	123	126	126	126	60
Nov.	101	101	101	101	107	114	120	120	123	54
Dec.	95	95	95	98	101	107	114	117	117	47

TABLE 12 Cooling load factors (CLF) for glass without interior shading, north latitudes, general

Fenestration Facing	Room Construction	Solar time (h) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N (Shaded)	L	0.17	0.14	0.11	0.09	0.08	0.33	0.42	0.48	0.56	0.63	0.71	0.76	0.80	0.82	0.82	0.79	0.75	0.84	0.61	0.48	0.38	0.31	0.25	0.20
	M	0.23	0.20	0.18	0.16	0.14	0.34	0.41	0.46	0.53	0.59	0.65	0.70	0.73	0.75	0.76	0.74	0.75	0.79	0.61	0.50	0.42	0.36	0.31	0.27
	H	0.25	0.23	0.21	0.20	0.19	0.38	0.45	0.49	0.55	0.60	0.65	0.69	0.72	0.72	0.72	0.70	0.70	0.75	0.57	0.46	0.39	0.34	0.21	0.28
NNE	L	0.06	0.05	0.04	0.03	0.03	0.26	0.43	0.47	0.44	0.41	0.40	0.39	0.39	0.38	0.36	0.33	0.30	0.26	0.20	0.16	0.13	0.10	0.08	0.07
	M	0.09	0.08	0.07	0.06	0.06	0.24	0.38	0.42	0.39	0.37	0.37	0.36	0.36	0.36	0.34	0.33	0.30	0.27	0.22	0.18	0.16	0.14	0.12	0.10
	H	0.11	0.10	0.09	0.09	0.08	0.26	0.39	0.42	0.39	0.36	0.35	0.34	0.34	0.33	0.32	0.31	0.28	0.25	0.21	0.18	0.16	0.14	0.13	0.12
NE	L	0.04	0.04	0.03	0.02	0.02	0.23	0.41	0.51	0.51	0.45	0.39	0.36	0.33	0.31	0.28	0.26	0.22	0.19	0.15	0.12	0.10	0.08	0.06	0.05
	M	0.07	0.06	0.06	0.05	0.04	0.21	0.36	0.44	0.45	0.40	0.36	0.33	0.31	0.30	0.28	0.26	0.23	0.21	0.17	0.15	0.13	0.11	0.09	0.08
	H	0.09	0.08	0.08	0.07	0.07	0.23	0.37	0.44	0.44	0.39	0.34	0.31	0.29	0.27	0.26	0.24	0.22	0.20	0.17	014	0.13	0.12	0.11	0.10
ENE	L	0.04	0.03	0.03	0.02	0.02	0.21	0.40	0.52	0.57	0.53	0.45	0.39	0.34	0.31	0.28	0.25	0.22	0.18	0.14	0.12	0.09	0.08	0.06	0.05
	M	0.07	0.06	0.05	0.05	0.04	0.20	0.35	0.45	0.49	0.47	0.41	0.36	0.33	0.30	0.28	0.26	0.23	0.20	0.17	0.14	0.12	0.11	0.09	0.08
	H	0.09	0.09	0.08	0.07	0.07	0.22	0.36	0.46	0.49	0.45	0.38	0.33	0.30	0.27	0.25	0.25	0.21	0.19	0.16	0.14	0.12	0.12	0.11	0.10
E	L	0.04	0.03	0.03	0.02	0.02	0.19	0.37	0.51	0.57	0.57	0.50	0.42	0.37	0.32	0.29	0.25	0.22	0.19	0.15	0.12	0.10	0.08	0.00	0.05
	M	0.07	0.06	0.06	0.05	0.05	0.18	0.33	0.44	0.50	0.51	0.40	0.39	0.35	0.31	0.29	0.26	0.23	0.21	0.17	0.15	0.12	0.11	0.10	0.08
	H	0.09	0.09	0.08	0.08	0.07	0.20	0.34	0.45	0.49	0.49	0.43	0.36	0.32	0.29	0.26	0.24	0.22	0.19	0.17	0.15	0.13	0.12	0.11	0.10
ESE	L	0.05	0.04	0.03	0.03	0.02	0.17	0.34	0.49	0.58	0.61	0.57	0.48	0.41	0.36	0.32	0.28	0.24	0.20	0.16	0.13	0.10	0.09	0.07	0.06
	M	0.08	0.07	0.06	0.05	0.05	0.16	0.31	0.43	0.51	0.54	0.51	0.44	0.39	0.35	0.32	0.29	0.26	0.22	0.19	0.16	0.14	0.12	0.11	0.09
	H	0.10	0.09	0.09	0.08	0.08	0.19	0.32	0.43	0.50	0.52	0.49	0.41	0.36	0.32	0.29	0.26	0.24	0.21	0.18	0.16	0.14	0.13	0.12	0.11
SE	L	0.05	0.01	0.04	003	0.03	0.13	0.28	0.43	0.55	0.62	0.63	0.57	0.48	0.42	0.37	0.33	0.28	0.24	0.19	0.15	0.12	0.10	0.08	0.07
	M	0.09	0.08	0.07	0.06	0.05	0.14	0.26	0.38	0.48	0.54	0.56	0.51	0.45	0.40	0.36	0.33	0.29	0.25	0.21	0.18	0.16	0.14	0.12	0.10
	H	0.11	0.10	0.10	0.09	0.08	0.17	0.28	0.40	0.49	0.53	0.53	0.48	0.41	0.36	0.33	0.30	0.27	0.24	0.20	0.18	0.16	0.14	0.13	0.12
SSE	L	0.07	0.05	0.04	0.04	0.03	0.06	0.15	0.29	0.43	0.55	0.63	0.64	0.60	0.52	0.45	0.40	0.35	0.29	0.23	0.18	0.15	0.12	0.10	0.08
	M	0.11	0.09	0.08	0.07	0.06	0.08	0.16	0.26	0.38	0.48	0.55	0.57	0.54	0.48	0.43	0.39	0.35	0.30	0.25	0.21	0.18	0.16	0.14	0.12
	H	0.12	0.11	0.11	0.10	0.09	0.12	0.19	0.29	0.40	0.49	0.54	0.55	0.51	0.44	0.39	0.35	0.31	0.27	0.23	0.20	0.18	0.16	0.15	0.13
S	L	0.08	0.07	0.05	0.04	0.04	0.06	0.09	0.14	0.22	0.31	0.48	0.59	0.65	0.65	0.59	0.50	0.43	0.36	0.28	0.22	0.18	0.15	0.12	0.10
	M	0.12	0.11	0.09	0.08	0.07	0.08	0.11	0.14	0.21	0.31	0.42	0.52	0.57	0.58	0.53	0.47	0.41	0.36	0.29	0.25	0.21	0.18	0.16	0.14
	H	0.13	0.12	0.12	0.11	0.10	0.11	0.14	0.17	0.24	0.33	0.43	0.51	0.56	0.55	0.50	0.43	0.37	0.32	0.26	0.22	0.20	0.18	0.16	0.15
SSW	L	0.10	0.08	0.07	0.06	0.05	0.06	0.09	0.11	0.15	0.19	0.27	0.39	0.52	0.62	0.67	0.65	0.58	0.46	0.36	0.28	0.23	0.19	0.15	0.12
	M	0.14	0.12	0.11	0.09	0.08	0.09	0.11	0.13	0.15	0.18	0.25	0.35	0.46	0.55	0.59	0.59	0.53	0.44	0.35	0.30	0.25	0.22	0.19	0.16
	H	0.15	0.14	0.13	0.12	0.11	0.12	0.14	0.16	0.18	0.21	0.27	0.37	0.46	0.53	0.57	0.55	0.49	0.40	0.32	0.26	0.23	0.20	0.18	0.16
SW	L	0.12	0.10	0.08	0.06	0.05	0.06	0.08	0.10	0.12	0.14	0.16	0.24	0.36	0.49	0.60	0.66	0.66	0.58	0.43	0.33	0.27	0.22	0.18	0.14
	M	0.15	0.14	0.12	0.10	0.09	0.09	0.10	0.12	0.13	0.15	0.17	0.23	0.33	0.44	0.53	0.58	0.59	0.53	0.41	0.33	0.28	0.24	0.21	0.18
	H	0.15	0.14	0.13	0.12	0.11	0.12	0.13	0.14	0.16	0.17	0.19	0.25	0.34	0.44	0.52	0.56	0.56	0.49	0.37	0.30	0.25	0.21	0.19	0.17
WSW	L	0.12	0.10	0.08	0.07	0.05	0.06	0.07	0.09	0.10	0.12	0.13	0.17	0.26	0.40	0.52	0.62	0.66	0.61	0.44	0.34	0.27	0.22	0.18	0.15
	M	0.15	0.13	0.12	0.10	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.17	0.24	0.35	0.46	0.54	0.58	0.55	0.42	0.34	0.28	0.24	0.21	0.18
	H	0.15	0.14	0.13	0.12	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.19	0.26	0.36	0.46	0.53	0.56	0.51	0.38	0.30	0.25	0.21	0.19	0.17
W	L	0.12	0.10	0.08	0.06	0.05	0.06	0.07	0.08	0.10	0.11	0.12	0.14	0.20	0.32	0.45	0.57	0.64	0.61	0.44	0.34	0.27	0.22	0.18	0.14
	M	0.15	0.13	0.11	0.10	0.09	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.19	0.29	0.40	0.50	0.56	0.55	0.41	0.33	0.27	0.23	0.20	0.17
	H	0.14	0.13	0.12	0.11	0.10	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.21	0.30	0.40	0.49	0.54	0.52	0.38	0.30	0.24	0.21	0.18	0.16
WNW	L	0.12	0.10	0.08	0.06	0.05	0.06	0.07	0.09	0.10	0.12	0.13	0.15	0.17	0.26	0.40	0.53	0.63	0.62	0.44	0.34	0.27	0.22	0.18	0.14
	M	0.15	0.13	0.11	0.10	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.17	0.24	0.35	0.47	0.55	0.55	0.41	0.33	0.27	0.23	0.20	0.17
	H	0.14	0.13	0.12	0.11	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.25	0.36	0.46	0.53	0.52	0.38	0.30	0.24	0.20	0.18	0.16
NW	L	0.11	0.09	0.08	0.06	0.05	0.06	0.08	0.10	0.12	0.14	0.16	0.17	0.19	0.23	0.33	0.47	0.59	0.60	0.42	0.33	0.26	0.21	0.17	0.14
	M	0.14	0.12	0.11	0.09	0.08	0.09	0.10	0.11	0.13	0.14	0.16	0.17	0.18	0.21	0.30	0.42	0.51	0.54	0.39	0.32	0.26	0.22	0.19	0.16
	H	0.14	0.12	0.11	0.10	0.10	0.10	0.12	0.13	0.15	0.16	0.18	0.18	0.19	0.22	0.30	0.41	0.50	0.51	0.36	0.29	0.23	0.20	0.17	0.15
NNW	L	0.12	0.09	0.08	0.06	0.05	0.07	0.11	0.14	0.18	0.22	0.25	0.27	0.29	0.30	0.33	0.44	0.57	0.62	0.44	0.33	0.26	0.21	0.17	0.14
	M	0.15	0.13	0.11	0.10	0.09	0.10	0.12	0.15	0.18	0.21	0.23	0.26	0.27	0.28	0.31	0.39	0.51	0.56	0.41	0.33	0.27	0.23	0.20	0.17
	H	0.14	0.13	0.12	0.11	0.10	0.12	0.15	0.17	0.20	0.23	0.25	0.26	0.28	0.28	0.31	0.38	0.49	0.53	0.38	0.30	0.25	0.21	0.18	0.16
HOR	L	0.11	0.09	0.07	0.06	0.05	0.07	0.14	0.24	0.36	0.48	0.58	0.66	0.72	0.74	0.73	0.67	0.59	0.47	0.37	0.29	0.24	0.19	0.16	0.13
	M	0.16	0.14	0.12	0.11	0.09	0.11	0.16	0.24	0.33	0.43	0.52	0.59	0.64	0.67	0.66	0.62	0.56	0.47	0.38	0.32	0.28	0.24	0.21	0.18
	H	0.17	0.16	0.15	0.14	0.13	0.15	0.20	0.28	0.36	0.45	0.52	0.59	0.62	0.64	0.62	0.58	0.51	0.42	0.35	0.29	0.26	0.23	0.21	0.19

L = Light construction: frame exterior wall, 50 mm, approximate mass per unit of floor area = 146 kg/m².
M = Medium construction: 100 mm concrete exterior wall, 100 mm concrete floor slab, approximate mass per unit of floor area = 340 kg/m².
H = Heavy construction: 150 mm concrete exterior wall, 150 mm concrete floor slab, approximate mass per unit area of floor = 630 kg/m².

Adapted by permission from *ASHRAE Fundamentals*, 1989, Table 36

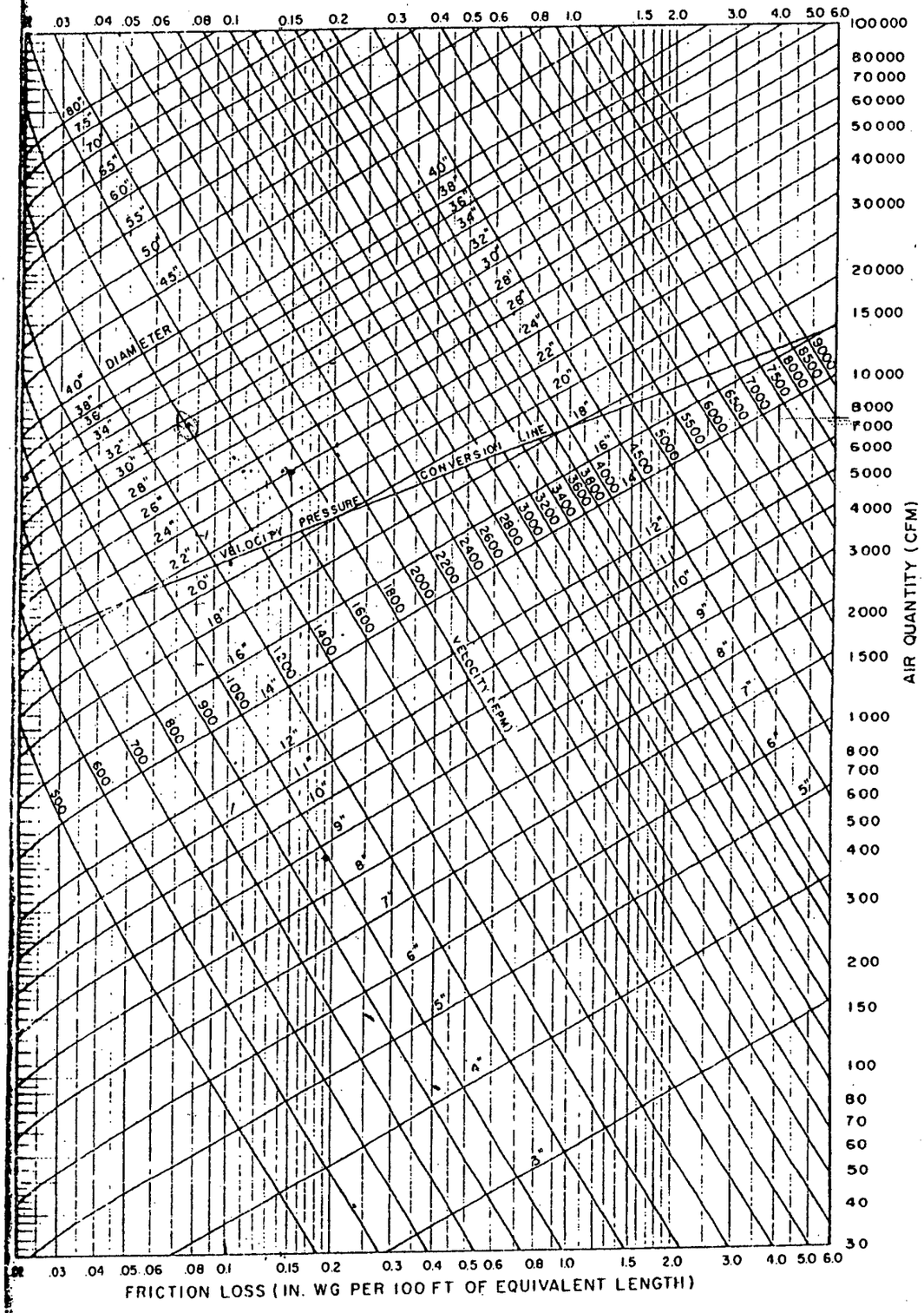
TABLE 20 Cooling load temperture differences (CLTD) for conduction through glass

Solar time, h	CLTD, °C	Solar time, h	CLTD, °C
0100	1	1300	7
0200	0	1400	7
0300	−1	1500	8
0400	−1	1600	8
0500	−1	1700	7
0600	−1	1800	7
0700	−1	1900	6
0800	0	2000	4
0900	1	2100	3
1000	2	2200	2
1100	4	2300	2
1200	5	2400	1

TABLE 21 Shading coefficients for single glass and insulating glass[a]

Type of glass	Nominal thickness[b]	Solar trans.[b]	Shading coefficient	
			h_0 = 22.7	h_0 = 7.0
A. Single Glass				
Clear	3 mm	0.86	1.00	1.00
	6 mm	0.78	0.94	0.95
	10 mm	0.72	0.90	0.92
	13 mm	0.67	0.87	0.88
Heat absorbing	3 mm	0.64	0.83	0.85
	6 mm	0.46	0.69	0.73
	10 mm	0.33	0.60	0.64
	13 mm	0.24	0.53	0.58
B. Insulating Glass				
Clear out, Clear in	3 mm[c]	0.71[c]	0.88	0.88
Clear out, Clear in	6 mm	0.61	0.81	0.82
Heat absorbing[d] Out, Clear in	6 mm	0.36	0.55	0.58

—FRICTION LOSS FOR ROUND DUCT



—DUCT DIMENSIONS, SECTION AREA, CIRCULAR EQUIVALENT DIAMETER,* AND DUCT CLASS†

SIDE	6		8		10		12		14		16		18		20	
	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.
10	.39	8.4	.52	9.5	.65	10.6										
12	.45	9.1	.62	10.7	.77	11.9	.94	13.1								
14	.52	9.8	.72	11.5	.91	12.9	1.09	14.3	1.28	15.3						
16	.59	10.4	.81	12.2	1.02	13.7	1.24	15.1	1.45	16.3	1.67	17.5				
18	.66	11.0	.91	12.9	1.15	14.5	1.40	16.0	1.63	17.3	1.87	18.5	2.12	19.7		
20	.72	11.5	.99	13.5	1.26	15.2	1.54	16.8	1.81	18.2	2.07	19.5	2.34	20.7	2.61	21.9
22	.78	12.0	1.08	14.1	1.38	15.9	1.69	17.6	1.99	19.1	2.27	20.4	2.57	21.7	2.86	22.9
24	.84	12.4	1.16	14.6	1.50	16.6	1.83	18.3	2.14	19.6	2.47	21.3	2.78	22.6	3.11	23.9
26	.89	12.8	1.26	15.2	1.61	17.2	1.97	19.0	2.31	20.6	2.66	22.1	3.01	23.5	3.35	24.8
28	.95	13.2	1.33	15.6	1.71	17.7	2.09	19.6	2.47	21.3	2.86	22.9	3.25	24.4	3.60	25.7
30	1.01	13.6	1.41	16.1	1.82	18.3	2.22	20.2	2.64	22.0	3.06	23.7	3.46	25.2	3.89	26.4
32	1.07	14.0	1.48	16.5	1.93	18.8	2.36	20.8	2.81	22.7	3.25	24.4	3.68	26.0	4.12	27.5
34	1.13	14.4	1.58	17.0	2.03	19.3	2.49	21.4	2.96	23.3	3.43	25.1	3.89	26.7	4.37	28.3
36	1.18	14.7	1.65	17.4	2.14	19.8	2.61	21.9	3.11	23.9	3.63	25.8	4.09	27.4	4.58	29.0
38	1.23	15.0	1.73	17.8	2.25	20.3	2.76	22.5	3.27	24.5	3.80	26.4	4.30	28.1	4.84	29.8
40	1.28	15.3	1.81	18.2	2.33	20.7	2.88	23.0	3.43	25.1	3.97	27.0	4.52	28.8	5.07	30.5
42	1.33	15.6	1.86	18.5	2.43	21.1	2.98	23.4	3.57	25.6	4.15	27.6	4.71	29.4	5.31	31.2
44	1.38	15.9	1.95	18.9	2.52	21.5	3.11	23.9	3.71	26.1	4.33	28.2	4.90	30.0	5.55	31.9
46	1.43	16.2	2.01	19.2	2.61	21.9	3.22	24.3	3.88	26.7	4.49	28.7	5.10	30.6	5.76	32.5
48	1.48	16.5	2.09	19.6	2.71	22.3	3.35	24.8	4.03	27.2	4.65	29.2	5.30	31.2	5.97	33.1
50			2.16	19.9	2.81	22.7	3.46	25.2	4.15	27.6	4.84	29.8	5.51	31.8	6.19	33.7
52			2.22	20.2	2.91	23.1	3.57	25.6	4.30	28.1	5.00	30.3	5.72	32.4	6.41	34.3
54			2.29	20.5	2.98	23.4	3.71	26.1	4.43	28.5	5.17	30.8	5.90	32.9	6.64	34.9
56			2.35	20.9	3.09	23.8	3.83	26.5	4.55	28.9	5.31	31.2	6.08	33.4	6.87	35.5
58			2.43	21.1	3.19	24.2	3.94	26.9	4.69	29.3	5.48	31.7	6.26	33.9	7.06	36.0
60			2.50	21.4	3.27	24.5	4.06	27.3	4.84	29.8	5.65	32.2	6.50	34.5	7.26	36.5
64			2.64	22.0	3.46	25.2	4.24	27.9	5.10	30.6	5.91	33.1	6.87	35.5	7.71	37.6
68					3.63	25.8	4.49	28.7	5.37	31.4	6.26	33.9	7.18	36.3	8.12	38.6
72					3.83	26.5	4.71	29.4	5.69	32.3	6.60	34.8	7.54	37.2	8.50	39.5
76					4.09	27.4	4.91	30.0	5.86	32.8	6.83	35.4	7.95	38.2	8.90	40.4
80					4.15	27.6	5.17	30.8	6.15	33.6	7.22	36.4	8.29	39.0	9.21	41.1
84							5.41	31.5	6.41	34.5	7.54	37.2	8.55	39.6	9.75	42.3
88							5.58	32.0	6.64	34.9	7.87	38.0	8.94	40.5	10.1	43.1
92							5.79	32.6	6.91	35.6	8.12	38.6	9.39	41.5	10.4	43.8
96							5.90	33.0	7.14	36.2	8.40	39.2	9.70	42.1	10.8	44.5
100									7.40	36.9	8.50	39.5	9.80	42.5	11.3	45.5
104									7.60	37.4	8.90	40.5	10.2	43.5	11.6	46.2
108									7.90	38.0	9.20	41.2	10.6	44.0	12.0	47.0
112									8.10	38.6	9.50	41.8	10.9	44.7	12.3	47.5
116																
120											9.80	42.4	11.3	45.5	12.6	48.1
124											10.0	42.8	11.5	46.0	13.1	49.1
128											10.3	43.5	11.9	46.7	13.4	49.6
132																
136											10.6	44.1	12.1	47.1	13.8	50.4
140													12.5	47.9	14.1	50.9
144													12.8	48.5	14.5	51.6
													13.0	48.8	14.7	52.0
													13.3	49.4	15.2	52.9

*Circular equivalent diameter (d_e) Calculated from $d_e = 1.3 \frac{(ab)^{.625}}{(a+b)^{.25}}$

*Large numbers in table are duct class

DUCT DIMENSIONS, SECTION AREA, CIRCULAR EQUIVALENT DIAMETER,* AND DUCT CLASS† (Cont.)

24		26		28		30		32		34		36		38		40	
Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.	Area sq ft	Diam in.
3.74	26.2																
4.03	27.2	4.40	28.4														
4.33	28.2	4.74	29.5	5.14	30.6												
4.68	29.3	5.07	30.5	5.48	31.6	5.86	32.5										
4.94	30.3	5.37	31.6	5.79	32.6	6.20	33.5	6.68	35.0								
5.24	31.0	5.69	32.3	6.15	33.6	6.60	34.5	7.06	36.0	7.54	37.2						
5.55	32.0	5.94	33.0	6.52	34.6	6.99	35.8	7.46	37.0	7.95	38.2	8.46	39.4				
5.85	32.8	6.38	33.2	6.87	35.5	7.34	36.7	7.87	38.0	8.37	39.2	8.89	40.4	9.43	41.6		
6.15	33.6	6.73	35.1	7.22	36.4	7.70	37.6	8.29	39.0	8.81	40.2	9.34	41.4	9.89	42.6	10.5	43.8
6.45	34.4	7.09	35.9	7.58	37.3	8.12	38.6	8.68	39.9	9.21	41.3	9.80	42.4	10.4	43.6	11.0	44.8
6.75	35.2	7.34	36.7	7.99	38.1	8.50	39.5	9.07	40.8	9.61	42.0	10.3	43.4	10.8	44.6	11.4	45.8
7.03	35.9	7.63	37.4	8.25	38.9	8.85	40.3	9.48	41.7	10.1	43.0	10.7	44.3	11.3	45.6	11.9	46.8
7.30	36.6	7.93	38.2	8.59	39.7	9.25	41.2	9.89	42.6	10.5	43.9	11.1	45.2	11.8	46.5	12.4	47.8
7.59	37.3	8.25	38.9	8.93	40.4	9.60	42.0	10.3	43.5	10.9	44.8	11.6	46.1	12.2	47.4	13.0	48.8
7.87	38.0	8.55	39.6	9.25	41.2	9.96	42.8	10.7	44.3	11.4	45.7	12.1	47.1	12.7	48.5	13.5	49.7
8.16	38.7	8.85	40.3	9.64	42.0	10.4	43.6	11.0	45.0	11.8	46.5	12.6	48.0	13.2	49.2	14.0	50.6
8.43	39.3	9.18	41.0	9.94	42.7	10.7	44.3	11.4	45.8	12.2	47.3	13.0	48.6	13.7	50.1	14.5	51.5
8.73	39.8	9.46	41.7	10.3	43.4	11.0	45.0	11.8	46.6	12.6	48.1	13.4	49.6	14.2	51.0	15.0	52.4
8.99	40.4	9.75	42.3	10.5	44.0	11.4	45.8	12.2	47.3	13.0	48.9	13.8	50.4	14.6	51.8	15.5	53.3
9.23	40.8	10.0	43.5	10.8	44.8	12.1	47.2	12.9	48.7	13.8	50.4	14.7	52.0	15.5	53.4	16.5	55.0
9.48	42.8	10.9	44.7	11.8	46.6	12.8	48.4	13.7	50.2	14.6	51.8	15.6	53.5	16.5	55.0	17.5	56.6
9.74	43.8	11.5	46.9	12.4	47.8	13.5	49.7	14.4	51.5	15.4	53.2	16.4	54.9	17.4	56.5	18.3	58.0
9.98	44.9	12.0	47.8	12.9	49.0	14.1	50.8	15.1	52.7	16.2	54.6	17.3	56.3	18.3	57.9	19.3	59.5
10.5	46.0	12.6	48.0	13.7	50.1	14.7	52.0	15.8	53.9	17.0	55.8	18.1	57.6	19.2	59.3	20.3	61.0
10.0	46.9	13.2	49.2	14.2	50.1	15.4	53.2	16.5	55.0	17.7	57.0	18.9	58.9	20.1	60.7	21.2	62.4
10.5	47.9	13.7	50.3	14.8	52.2	16.1	54.1	17.3	56.3	18.5	58.2	19.7	60.1	20.9	62.0	22.1	63.7
10.9	48.7	14.2	50.1	15.5	53.4	16.7	55.4	18.0	57.4	19.2	59.4	20.5	61.3	21.8	63.2	23.0	65.0
11.3	49.5	14.8	52.2	15.9	54.0	17.2	56.2	18.6	58.5	19.7	60.2	21.1	62.2	22.7	64.5	24.0	66.3
11.9	50.6	15.0	52.5	16.7	55.3	17.9	57.3	19.2	59.4	20.6	61.5	21.6	63.0	23.4	65.5	24.8	67.5
12.6	51.8	15.8	53.9	17.3	56.0	18.6	58.5	19.9	60.5	21.4	62.6	22.7	64.5	24.1	66.5	25.6	68.5
12.8	52.1	16.2	54.6	17.8	56.8	19.2	59.4	20.5	61.4	22.0	63.5	23.5	65.7	24.8	67.5	26.5	69.7
13.1	52.7	16.8	55.5	18.3	58.0	19.7	60.1	21.1	62.3	22.5	64.3	24.5	67.0	25.7	68.7	27.1	70.5
13.8	53.0	17.3	56.4	18.9	58.9	20.3	61.1	22.0	63.6	23.5	65.7	24.8	67.5	26.2	69.4	28.2	70.9
14.2	54.6	17.8	57.1	19.4	59.6	20.9	62.0	22.7	64.5	24.2	66.7	26.1	69.2	27.2	70.6	29.0	73.0
14.6	55.2	18.4	58.1	19.8	60.2	21.6	63.0	23.2	65.4	25.2	68.0	26.5	69.8	28.2	71.9	29.8	74.0
15.1	56.0	18.8	58.8	20.3	61.1	22.3	64.0	23.7	66.0	25.6	68.6	27.3	70.8	28.7	72.6	30.2	74.5
15.4	56.5	19.3	59.5	20.8	61.8	22.6	64.4	24.5	67.0	26.3	69.5	28.2	72.2	29.8	74.0	32.0	76.6
15.9	57.3	19.7	60.2	21.4	62.7	23.3	65.0	25.1	67.9	26.9	70.3	28.7	73.0	30.3	74.8	32.6	77.3
16.3	58.1	20.3	61.0	22.3	64.0		66.5	25.9	69.0	27.5	71.1	29.4	73.5	31.5	76.0	33.4	78.3
16.8	58.7	20.6	61.5	22.7	64.5	24.8	67.5	26.3	69.5	28.2	72.0	29.9	74.2	32.2	76.9	34.0	79.0

*Circular equivalent diameter (d_e) Calculated from $d_e = 1.3 \frac{(ab)^{.625}}{(a+b)^{.25}}$

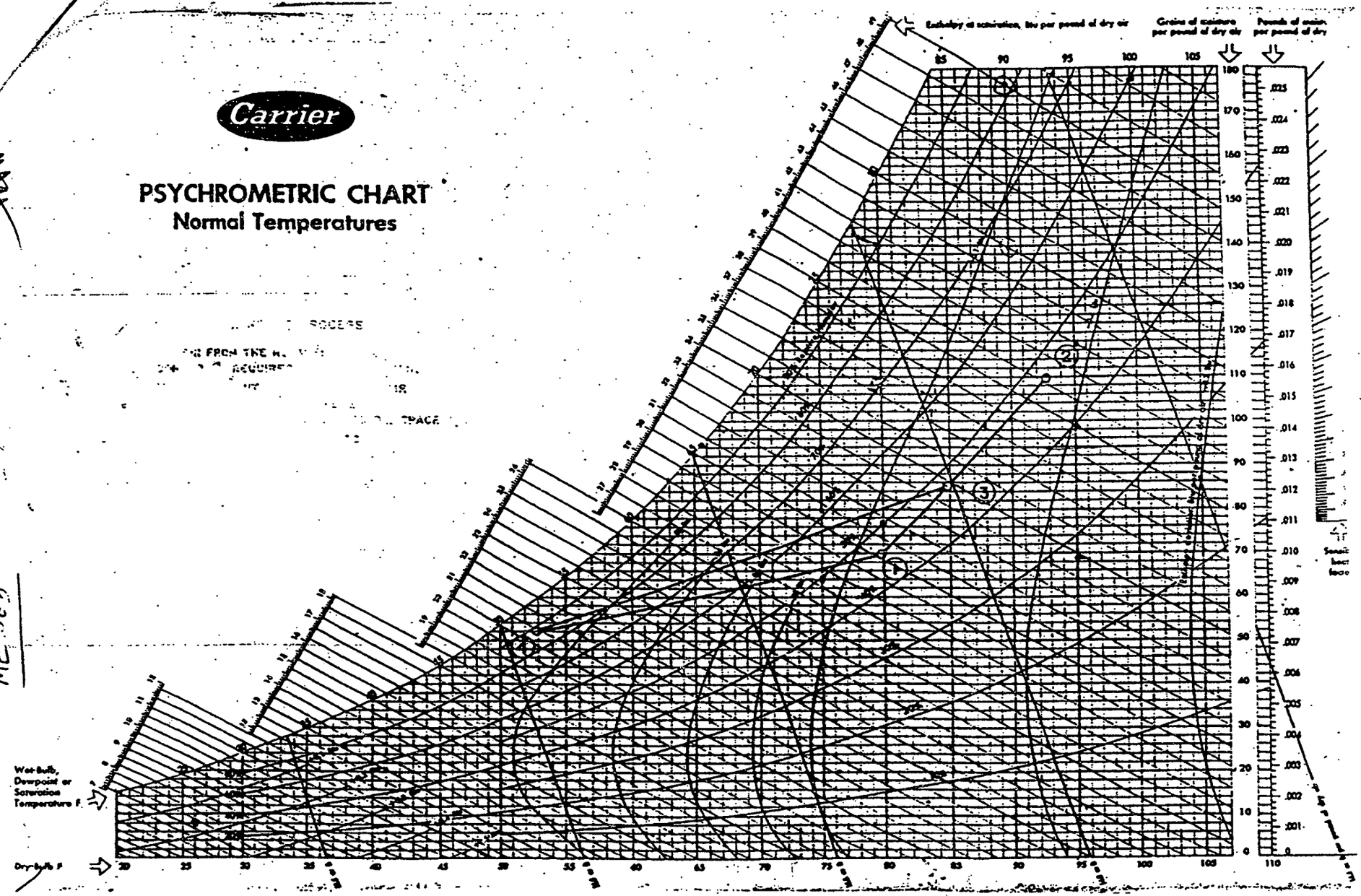
*Large numbers in table are duct class

(12)

(13)

Carrier

PSYCHROMETRIC CHART
Normal Temperatures



ME 363

L-3/T-1/ARCH **Date : 26/01/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Examinations 2010-2011

Sub : **HUM 315** (Logic and Philosophy)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THEEE**.

1. (a) What is meant by logic? **(5)**

   (b) Explain with example premises and conclusion. **(12 ⅓)**

   (c) What are the differences between 'Term' and 'Word'? **(6)**

2. (a) What is argument? **(5)**

   (b) "Deductive argument goes from universal to particular and inductive argument goes from particular to universal: - Explain with examples. **(13 ⅓)**

   (c) Discuss the nature of sound argument. **(5)**

3. (a) What is inference? **(5)**

   (b) What do you mean by fallacy? **(5)**

   (c) Discuss different types of informal fallacy. **(13 ⅓)**

4. (a) What is meant by synthetic judgment and analytic judgment? **(8)**

   (b) Explain with example any three types of definition. **(15 ⅓)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What is philosophy? Discuss the importance of philosophy. **(13)**

   (b) Explain 'ethics' and 'aesthetics' as a branch of philosophy. **(10)**

6. (a) Define science with examples. **(8)**

   (b) Discuss the relation between philosophy and science. **(15 ⅓)**

7. (a) Define epistemology and mention the sources of knowledge. **(8)**

   (b) What is meant by innate idea? How does Jhan Locke criticize the theory of innate idea of Rena Descartes? **(15 ⅓)**

8. (a) What is the philosophy of Thales? Discuss the importance of his philosophy. **(10)**

   (b) Explain after Protagoras, theory of knowledge. How does Plato criticize the theory of knowledge of Protagoras? **(13 ⅓)**
